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ANNUAL REPORT

1943

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION*

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*Maintained at Berkeley, California,
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The wartime program of 1943 for this Station was built around two aims: (1) to make accumulated knowledge and experience available for immediate war needs; and (2) to carry on the most essential long-range projects on a bare maintenance level — the better to prevent loss of past investment and to prepare for the anticipated big demand upon us for resource-management facts. In place of the usual detailed annual report, this brief statement of high lights of the Station's work for the year is submitted.

SURVEYS AND RESEARCH SERVICES FOR WAR AGENCIES

During 1943 the Station continued its share of the cooperative work being carried on by the Forest Service primarily for the War Production Board and having as its major objective the conduct of fact-finding surveys for the war agencies controlling the Nation's lumber production. A sizable portion of our manpower and facilities was devoted to this task.

Lumber production in California in 1943 was only 0.1 percent less than in 1942. The decrease represents a 2-percent decrease in the pine region and a 6-percent increase in the redwood region. This is a remarkable record for the industry in view of the difficulties encountered and the record of other major producing regions. The information services provided by the Station are believed to have assisted policy and action agencies materially and thus to have contributed in some share to this production record. A digest of major accomplishments follows:

Each quarter a comprehensive appraisal of the factors affecting lumber production for both the pine and the redwood regions was prepared for the lumber branch of the War Production Board. These appraisals included a report of production to date, a forecast of expected production, an analysis of manpower problems, and an examination of equipment, weather, and other difficulties. The fall reports were expanded to include a summary of log inventories available for winter milling.

The 1943 census of lumber production, based on a 100-percent canvass of the 320 odd mills in California, was carried out for the War Production Board and the Bureau of the Census. This canvass obtained data by individual mills on lumber production and average selling price by timber species, days operated, shipments of lumber, lumber inventories, and purchases and sales of standing timber and logs.

Recurrent surveys of lumber production and stocks were continued. In cooperation with the California Redwood Association a statistical statement was prepared each month, reporting the production of lumber in the redwood region by species and by size-class of mill. A similar statement was prepared each quarter on inventories of lumber at sawmills.

Specialty surveys during the year dealt with various phases of lumber production. In addition to the periodic appraisals and surveys mentioned above a number of special investigations were made in order to satisfy war agencies' need for data on a particular subject at a specific time. A few of these surveys were —

(a) A food-rationing survey of logging camps in the State and number of men subsisted at each camp, with an accompanying appraisal of the reliance of logging camps on processed foods because of inaccessibility or lack of transportation or refrigeration.

(b) A survey of the approximately 600 lumber dry-kilns within California to determine their number, kinds, location, holding capacity, and present condition.

(c) For the Office of Agricultural War Relations a statement on the production and consumption of agricultural box shook and the principal factors affecting supply and demand, together with an estimate of prospective requirements and production in 1943 and recommendations regarding the necessary adjustments in price ceilings to insure meeting the demand.

(d) A statistical and interpretative report on the transportation of forest products within the State, including a summary of the volume of lumber, logs, and other forest products transported by various types of carrier and the distance hauled.

(e) An August forecast for the Interagency Log and Lumber Policy Committee summarizing the outlook for winter lumber operations in California. This report described the production outlook, enumerated the companies that planned to mill and log during the winter, and appraised winter production factors, particularly climatic conditions, equipment, road location, and accessibility of timber supply.

(f) A report on estimated production of and requirements for fuel wood in California in 1942 and 1943, which included a breakdown of statistics on a county basis and an appraisal of the factors affecting fuel-wood production.

Consultant and research services to war agencies were stressed. More and more during the year local, regional, and district offices of the various war agencies interested in lumber production turned to the Station for factual information. The War Production Board sought continuing advice on equipment needs of various operators, on needs for plant expansion as submitted to the Area Production Urgency Committee, and on probable production of individual operations. The War Manpower Commission relied on the Station to analyze its bi-monthly reports of current and anticipated employment in selected lumbering and logging operations in California. These compilations served as a guide to the regional and district War Manpower Commission offices in applying its West Coast Manpower plan to the lumber industry and in submitting recommendations on lumber manpower problems to the West Coast Lumber Commission. The West Coast Lumber Commission of the War Labor Board utilized the Station's reports on quarterly production problems as evidence in hearing

cases submitted by labor and management. The Western Log and Lumber Administrator of the War Production Board utilized the Station's periodic reports and called upon it for various types of special information on conditions in California. The Office of Price Administration consulted with the Station on problems of food rationing in the lumber industry and sought advice repeatedly on the effect of the various lumber, log, and stumpage price ceilings. The California Redwood Association cooperated closely with the Station in the monthly production and stock surveys and sought the help and loan of a Station man for a short period while carrying out an equipment survey initiated by the National Lumber Manufacturers Association for the War Production Board. The U.S.D.A. State War Board has turned to the Station for factual information and advice on the best means of initiating a program designed to increase the output of small mills.

MANAGEMENT OF CALIFORNIA FORESTS

The impact of war conditions, reflected directly in heavy reduction in funds and manpower, has meant redirection of effort and costly curtailment of numerous projects in our main long-range program, along with considerable resultant loss in continuity of results. The aim has been to protect major values in past investments as far as possible by halting curtailment of the most vital work at the minimum maintenance level. Some projects, however, have been closed down completely, including the whole redwood program following Person's transfer to the Pacific Northwest Station on a special war job. Our remaining force has been concentrated on (1) the Blacks Mountain logging experiment and (2) close collaboration with Region 5 in getting available information into usable shape and application.

In the Blacks Mountain logging experiment the Station logged about 8 million feet of lumber used for war purposes and at the same time added to the accumulating fund of information required for the main objective of the experiment: to discover, test, and demonstrate on a convincing practical scale the management and silvicultural practices needed to insure adequate future crops of wood at low cost from ponderosa pine lands. The logging, office, and research operations in conjunction with these experiments were carried on successfully by men ineligible for military duty because of age and physical condition and by women.

During the year, 1,593 acres of the experimental forest were logged, divided among cutting methods as follows: "light sanitation salvage," 324 acres; "moderate Forest Service selection," 26 acres; "heavy Forest Service selection," 26 acres; and "release cutting," 1,217 acres. Under release cutting the volume removed varied from 3,090 to 7,935 feet per acre.

This experiment will demonstrate whether it is economically feasible to cut as little as 3,000 board feet per acre. By making a series of variable cuts, properly timed and placed, instead of a single progressive heavy cut, it is thought possible to harvest highly susceptible trees prior to bark beetle attack, accomplish natural restocking, release advance growth, prevent brush invasion, and provide logs of certain quality grades as needed.

With respect to control of losses, areas cut in 1937 by the sanitation-salvage method removing 15 percent of the volume still show a loss reduction of more than 80 percent. Output this season was 2,225 board feet per man-day for sanitation-salvage cutting — actually exceeding the rate for heavier cutting. Log-making required 76 minutes per M bd.ft., as against 78 minutes for the heavier cutting. It is to be expected that total logging costs will be somewhat greater than for complete liquidation in one operation. On the other hand, the saving of timber that would be ruined if attacked by insects, the avoiding of expense of direct insect-control treatments, the probable security of timber left uncut, and the higher net growth are compensating features encouraging to landowners who wish to defer liquidation or practice forest management.

A more versatile portable log loader was designed, built, and used successfully during the season. On 32 moves of landings, which averaged 1,845 feet, the elapsed time averaged 15½ minutes. Such a rig is essential where variable selection cuttings are being made and it has proved of interest to several private operators.

Getting forest research findings into application, a continuing and major responsibility of research as an assistance to administration, was stressed during the year as far as diminished manpower and facilities permitted.

Harvest-cutting research during the past 34 years was drawn upon to formulate simple cutting practices adapted to local variations in site, type, stocking, and age of stand. These might serve as a guide to progressive forest owners or as a basis for regulating cutting on private land. The same principles can be elaborated for local intensification of national forest practices. The Station was called upon for assistance in connection with volume tables, methods of site classification, growth prediction in mixed stands, and methods of inventorying forest land. A growth forecast was made for the State-wide post-war plan.

The possibilities of scaling by sampling to save manpower were investigated and found impracticable under local conditions. A trial of gross scaling was recommended together with revisions of volume tables to enable sales by tree estimates. Sampling present-day top utilization was undertaken to enable revision of the tables as well as for use in Regional appraisals.

In forest regeneration, attention was directed toward maintaining conditions of the roots of pine planting stock favorable to field survival. Results of a root-pruning and water-use study indicated that improper methods of handling stock rather than adverse site conditions probably are mostly to blame for field losses. A trial of recognized chemical stimulants resulted in no improvement in root regeneration.

FOREST GENETICS

This project is emerging from the pioneering stage and is beginning to take definite form. In addition to producing several new hybrids on a quantity production basis, the tree-breeding work has confirmed the assumption that, as in many other plant groups, pine hybrids will generally be intermediate between the parent species. Again as in other plant groups there are exceptional cases where the hybrid exceeds both parents in vigor. The pattern of behavior is the same whether two certain individual trees be crossed or whether mixed pollen from a large number of trees of one species be applied to a number of seed trees of the other species. The mixture of pollen is of course more effective from a statistical standpoint in showing the true characters of a hybrid between species. Finally, the original results obtained from the crossings, Pinus Jeffreyi X P. ponderosa, and P. monticola X P. strobus, have now been repeated in 3 different years and with different individual seed- and pollen-parents. These seedlings exhibit a very promising degree of vigor and hardiness. In short these hybrids are NEW TREES — and apparently superior ones under the conditions of the test.

A very important finding essential to the future of tree improvement was further verification of the fertility of pine hybrids.

Other studies whose results were carried during the year to the stage of advanced analysis or early publication include (1) reliability of nursery differences in height as a criterion of vigor, (2) a new concept in vegetative propagation of pines, (3) viability of seed of 46 species of pine stored for from 8 to 18 years, (4) unexpected results on formation of oleoresin in grafted pines, and (5) a post-war reference handbook on the growth, hardiness, silvicultural values, and other characteristics of "The Pines of the Eddy Arboretum — Institute of Forest Genetics."

The farther these experiments can be pushed along during wartime the better equipped post-war plans will be to make extensive use of the superior types of trees that will be needed in large quantities for reforestation of brush fields and burned-over or denuded timber lands.

CORK OAK

The job of learning where and how cork oak may be grown in California is progressing satisfactorily. The seed spotting done in the winter of 1942-43 in the southern section of the State where the rainfall is normally around 12-20 inches, has yielded very interesting results. Where acorns were planted directly in the field, only weeding and protection from livestock and rodents were necessary to insure establishment of the plantation. In January 1944, 10 small plots and 3 larger plantations were established in selected locations throughout the State to test suitability of site, kind of stock, and various treatments. One plot of 7,000 seedlings was planted for growth, thinning and stripping studies at some future date.

Because of labor shortage, transportation restrictions it was not possible to use experimentally all of the nursery stock grown last year. Through the University of California our primary cooperator, 75,000 of the seedlings were distributed to land owners.

Dr. Stockwell of this Station represented the Department of Agriculture in a cork collection trip in Spain sponsored by the Crown Cork & Seal Co., of Baltimore, Md. Seven tons of acorns were shipped to this country. The viability of these acorns upon arrival remains to be determined, since the anticipated cold-storage shipping facilities were unobtainable. Representative samples of these Spanish collections will be tested this year by both the Southern and the Southwestern Forest Experiment Stations as well as the California Station. Studies designed to further this project have supplied essential information on the minimum requirements for acorn storage.

FOREST FIRE PROTECTION

A major part of the fire division's research effort during 1943 was devoted to the field of fire behavior and to the application of results of behavior studies to the job of fire control. Basic studies of fire behavior and of the factors that affect it were continued on a reduced scale throughout the year.

Laboratory and wind-tunnel studies of fuel characteristics and of model-scale fires added further information on the effects of different fuel combinations on fire spread. For the first time temperature of the fuel was found to be one of the more important factors affecting both the ease of ignition of forest fuels and the rates of spread of surface fires.

How wind velocity, temperature, and fuel moisture vary in forest stands and how they are related to the measurements taken at exposed weather stations was further studied to provide additional information needed in the extension of experimental results to field practice.

These new findings were blended with the results of past work to provide the basis for complete revision of the fire-danger rating system in use on the California national forests and on areas protected by the State. This revision was completed during the year. The new system combines the effects of wind velocity, indicator-stick moisture content, seasonal development of herbs and shrubs, relative humidity, temperature, and slope into a single index of potential rate of fire spread. From analysis of past fire and weather records and of past manpower organization strength, a uniform system was developed for determining needed manpower for different levels of fire danger on each protection unit. This tool in protection management, placed in operation on most national forests of Region 5 by July 1, requires much less time of the field force and promises to add considerable significance to fire-danger measurements in this region. The new danger-rating system can incorporate additional facts and refinements as they become available, without disrupting the method of rating. Lack of such flexibility has been a major disadvantage in the systems used in this region in the past.

Much of last year's field work in the study of weather relationships in and adjacent to forest stands was done in cooperation with the University of California and the National Defense Research Committee. This pooling of staff and equipment resulted in a direct and important Station contribution to the war effort and expedited our own program at the same time.

Earlier work in planning intensified protection of the East Bay Hills area was followed up by participation in conferences with the Committee set up by 15 agencies to carry out the "disaster plan," and by assistance in the training of field personnel.

In the continuing study of large-fire behavior, considerable assistance was given to suppression forces in scouting the fires, in predicting probable changes in fire behavior, and in helping plan suppression strategy. More important was the background value of these observations in interpretation of research data and in close collaboration with Region 5 on actual "Class E" fires in southern California.

RANGE RESEARCH

Increased wartime meat production was promoted during the year on both foothill and mountain ranges. Continuance of research, although necessarily on a reduced plane, has added to the store of facts needed for the "blueprints" of many post-war range development programs. Continuity has been maintained on most of the long-range studies aimed at most efficient production of range lands; the rest have been further curtailed.

Significant new findings continue to emerge from the cooperative experiments reported upon 2 years ago in broad coverage in University of California Bulletin 663, "The San Joaquin Experimental Range." From the animal husbandry data (the responsibility of the University) evidence accumulates to show that the heaviest grazed areas are grazed too closely for the good of the cattle, as reported in that bulletin. In these areas the inadequate feed supply is reflected in animal condition, total gains, weaning weight of calves, calf crop, and development of growing animals. (Brief mention should be made of a related animal husbandry finding: establishment of the principle of "continuous growth," reported in various releases by the University. In conjunction with results of tests with supplemental feeding, this is one of the major contributions from the cooperative program on this experimental range.) These animal husbandry findings support and strengthen our forage and soil criteria of over-utilization, which in the main are less spectacular but significant. Marked delay — from 2 to 3 weeks — in the date of range readiness is perhaps the most obvious result of very close use. Others are less noticeable and are difficult to measure; some are even debatable. For example, no changes in density, correlated with intensity of grazing in this annual type, have occurred to date. This result is in sharp contrast of course, with results of many studies in perennial types of forage. The total amount of legumes appears to remain about the same under three degrees of use: light, moderate and very heavy. Still, as determined by lower height growth, apparently somewhat reduced vigor, and as yet inconclusive measurements of yield, it appears that the difference between closely grazed and moderately grazed areas is gradually widening. Thus far, however, during the period of the tests rainfall and forage conditions have been average or above. Measurements and results from some dry years will be needed to round out the vital story of how to graze ranges correctly — that is, how to get the greatest production of meat without sacrificing future yield through overuse.

Tentative grazing standards for annual-type range were worked out, based chiefly on results from the San Joaquin Experimental Range. The standard, defined and illustrated in Technical Note No. 21 "Standards for Judging the Degree of Forage Utilization on California Annual-Type Ranges", is particularly important at the present time because of the heavy wartime demand for meat and other livestock products, and is in use also by the Agricultural Adjustment Administration, and the Soil Conservation Service.

A "pilot run" in the latter part of last summer to test the soundness of the experimental set-up on the Harvey Mountain (Burgess Spring) pastures, Blacks Mountain Branch, proved extremely valuable in planning work for the coming season. If circumstances permit a complete seasonal set of data directly usable in management will be obtained this year. Such information bears directly on how mountain meadows should be grazed with adjoining timber-type forage to insure the greatest livestock production and the best conservation of mountain ranges. Moreover, the information is eagerly sought by Administration to guide and strengthen their programs of mountain-meadow fencing in the post-war construction period.

In continued study of the problem of bitterbrush reseeding, experimental spring plantings were made with stratified seed on 6 eastside national forests. Rangers participated in the work and kept records of the survival of seedlings during the summer. Of the seedlings that germinated, 25 percent survived, compared with a survival of 68 percent from seed cached by rodents the previous fall. The poorer survival of the spring-planted seed is attributed mainly to faulty planting. These trials together with laboratory and other experiments carried on during the year indicate that fall planting (comparable to planting by rodents) should give the best results. A summary of the results of the spring planting has been forwarded to the eastside forests, pending further development of practical large-scale reseeding methods which are needed now for most effective post-war planning.

Several weeks were spent with personnel of the Regional Office and Modoc Forest in planning and starting a study on the Modoc Plateau, to obtain information on the amount and kind of forage eaten by deer during the winter period. Research Note No. 35, "A Method of Estimating Grazing Use of Bitterbrush" was prepared as an aid to this project.

On range reseeding the limited amount of work possible last year added to our stock of slowly accumulating information needed to define the place of reseeding in the improvement and management of California foothill lands. Much remains to be done but one fact seems clear: reseeding cannot be looked upon as a cure-all for range ills. Very likely its greatest value will lie in improvement of small areas to be used at definite times to fill definite needs in the yearly feed supply of each ranch, rather than in widespread seeding of large blocks of land.

FOREST INFLUENCES RESEARCH

In the Division of Forest Influences, effort of the technical staff was concentrated largely on the working up and analysis of accumulated data and the preparation of material for publication. The proportion of time devoted to research has stepped up steadily during the past year and is still increasing.

Last year we reported the important part played in recent flood control reports by a method of hydrologic analysis developed by the Station. An explanatory paper was published during the year. Briefly stated, the method is the integration, for any given watershed, of data of precipitation, infiltration, soil-water, soil type and depth, rock structure, and vegetation in such a manner that a complete accounting is made of the disposition of the precipitation that falls on the watershed. It makes possible the prediction of the probable runoff of storms of any magnitude and thus facilitates the appraisal of any proposed program of watershed improvement through land use changes which affect the responsive factors such as infiltration and surface run-off. Although used extensively in the flood control surveys, this approach is also helping materially to improve the gathering of hydrologic data on the San Dimas Experimental Forest.

The comparative study of rain gages, published by the Geophysical Union, is a step forward in the problem of obtaining accurate rainfall measurements in rough mountain terrain. By comparing the catchment of various types of rain gages at standard heights and at ground surface level with the catchment of control gages in the form of large impervious surfaces at ground level, this study shows that rainfall measurements made with the standard 8-inch rain gage are consistently low. Further indications are that the standard gage tilted with its axis normal to the mountain slope on which it stands approaches in accuracy the impervious surface control gage. Awaiting publication are results of two additional studies relating to rain catchment by variously placed rain gages. What we hope will be the final step in this complex problem is the development of a formula for correcting the records of standard vertical gages in mountain areas. This requires a thorough examination of available data in the light of the mathematical theory underlying the problem. A substantial beginning on this analysis has been made.

In the field of soil moisture, the study of field capacity by natural and artificial irrigation has shown that these mountain soils must be wetted 12 inches to 30 inches deep before the surface layer will have attained a maximum field capacity value. Soil as deep as 30 inches cannot be raised to its maximum value until the wet front has penetrated from 36 inches to 42 inches below the soil surface. These findings are important in interpretation of precipitation effectiveness.

The analysis of annual soil water cycles in the four types of lysimeters, which form the San Dimas installation, is in rough draft. The finding that the soil water cycle in one type of lysimeter is not related to the cycle in any other types might preclude or at least complicate the comparative study of the water economy of vegetation grown in different types of lysimeters. Even in the use of any single type for studies of water use by vegetation, we still

face the problem of the saturated soil layer near the bottom of all lysimeters resulting from the interface between soil and air at the seepage outlet. The forthcoming paper will review new developments in coping with this problem.

In the field of chaparral ecology, a detailed cover type map of Monroe Canyon and an extensive map of about three-fourths of the whole San Dimas Forest have been completed. This map will serve many needs in analysis and interpretation of data on water yield.

In close cooperation with the Region and the southern California forests, in connection with the Arroyo Seco flood control project and with the cover crop sowing on burns during the year, several field examinations were made, and memorandum reports and recommendations were submitted. In the Arroyo Seco, the road slope treatments, including wattling, staking with baccharis, sowing with rye and planting with Coulter and knobcone pine, were in general very successful, and were recommended for extension as needed on roads throughout the Arroyo. Failure of some treated road slopes occurred where fresh overcast had been deposited on previously eroded and semi-consolidated slopes at angles steeper than the normal repose for the material. The treatment of natural landslides has been only sparingly effective in hastening the revegetation of such areas. Further experimental treatment was recommended.

During the year plans were begun for the second phase of the Arroyo Seco model study, namely, the investigation of channel control on the ultimate debris-filled channel bottom by means of vegetation and secondary structures. We hope to work out some way of completing this study in cooperation with the University and the Region. Loss of manpower forced suspension of this project.

Considerable time was required in connection with the first-aid treatment of burns on the Cleveland and San Bernardino Forests. An intensity rain gage, installed in the Hauser burn on the Cleveland, has showed no storms during the past winter heavy enough to produce serious erosion. Instructions for examining and reporting upon the growth and effectiveness of the mustard and native vegetation were prepared at the Region's request for use by the Forest staff. A comprehensive manual, for the use of the Region and the forests in sizing up new burns and preparing and executing plans for mustard sowing thereon, was completed during the year and issued as Station Research Note No. 37.

The planting stock at Devil Canyon nursery was disposed of in filling requests of various Army posts, the national forests in southern California, and several public institutions. This stock included approximately 15,000 bare-root conifers, and several thousand potted shrubs and trees. Of the potted cork-oak stock, approximately 10,000 were used in planting experiments by the University Extension Forester, 10,000 were taken by the southern California Forests and public institutions, and about 10,000 transferred to the San Dimas Experimental Forest for further distribution and local planting.

From our native plant nursery in Berkeley, where propagation was limited to cork oak, several thousands of potted shrubs, left over from last year, were distributed to military centers in the San Francisco Bay area. A considerable number of requests for advice on planting were handled by the Division.

Further curtailment of field activities "for the duration" included the closing down of Devil Canyon Branch Station and the turning over of our Kings River headquarters at Trimmer to the Sierra Forest under a cooperative arrangement whereby the Forest staff continues to obtain certain minimum hydrologic records in return for the use of our buildings.

REDIRECTION OF PRODUCTS AND ECONOMICS

With Garland continuing to devote practically all his time to the Requirements and Supplies surveys, the regular program of the Division of Products remained suspended. A small amount of research and consultative services was possible on problems presented by war agencies and industry, but this represents only a small fraction of the potential service that would be required to match the high and increasing interest in wood utilization in this region.

Complete suspension of Forest Economics work resulted from lack of funds and the full-time assignment of Crafts to the Requirements and Supplies surveys. For the present, therefore, no work is possible on any of the many economic problems of this region on "how to make forestry pay in financial and in indirect terms."

POST WAR PLANNING

The Station participated actively with Region 5 and with various departmental and State agencies in the preparation of the report of the Regional Interbureau Coordinating Committee on Post War Planning, and related Station plans.

FOREST SURVEY

Redirection to war jobs left the Survey work virtually closed down. Burks continued full-time on the R&S surveys. Jensen was detailed practically full-time to the University of California to teach aerial photograph interpretation to military students. Wieslander divided most of his time between the Emergency Rubber Project and post-war planning.

With the small amount of available Survey staff time the groundwork was laid for two important tasks for 1944. The first comprises participation by the Survey Division in a Region 5 training program looking toward intensified resource development and management in the national forests. The plan contemplates teaching a selected group of Forest Service technicians, and a few from the State Department of Natural Resources, how to use aerial photographs advantageously as a tool in land management.

The second task is the preparation of a new report on the present and prospective sawtimber situation in California, involving compilation of all existing information. With the aid of the completed cover type maps supplemented by air photographs now available for most of the unsurveyed areas it is believed possible to make a much better estimate than any heretofore made, for area, volume and growth of the timber resource. This fresh size-up

of the timber situation, under leadership of the Survey Division, will be made possible by substantial cooperation from the Region.

COOPERATING AGENCIES

Our work continued to be closely tied in with the administrative program of Region 5 of the Forest Service, which has strengthened and supported our research program in many ways. Cooperation with various other agencies — federal, State, and community — was continued to the degree permitted by conditions.

The valued tie with the University of California, our primary research cooperator, involved several departments and divisions. The range cattle studies, integrated with our range management program at the San Joaquin Experimental Range, were continued during the year without major changes, under the direction of the Division of Animal Husbandry. The Department of Forestry assisted in surveys of supplies and requirements of Forest Products in the redwood region, and in the fields of Forest Influences, Forest Management, and Range. The Division of Soil Technology completed a soils map of the Stanislaus Experimental Forest. The Department of Chemistry participated in the study of fire weather. Consultation and advisory assistance was extended by a number of divisions, including among others the following: Irrigation, on soil-water relations; Zoology (Davis), on wildlife in relation to range; Agronomy, on range reseeding; Botany on various problems of common interest, and Mechanical Engineering, on fire research and on the model study of the Arroyo Seco channel problems. The offices of the Dean of the College of Agriculture and of the Director of Agricultural Extension participated importantly in the preparation of the interagency post-war planning report.

Cooperative studies of the Bureau of Entomology and Plant Quarantine, Department of Agriculture, were continued. These studies are vital to the solution of several forest management problems, especially those at our Blacks Mountain Branch Station. Project details will appear in the annual report of the above bureau.

The Fish and Wildlife Service, Department of the Interior, found it necessary to suspend, probably until after the war, the cooperative project of rodents in relation to range, and related studies, at the San Joaquin Range; also much-needed studies of wildlife and forest regeneration at our mountain work centers. In both groups of studies, however, general interagency contact was maintained by occasional consultations and field observations. In addition, the Fish and Wildlife Service handled the rodent-control phase of our cork-oak planting tests.

The Civilian Public Service Camps for conscientious objectors have given substantial assistance to our research programs at the San Dimas Experimental Forest, the Institute of Forest Genetics, the San Joaquin Experimental Range, and Kings River and Feather River Branch Stations. The excellent and valued services of these men have made possible the maintenance of several important research projects which would otherwise have been more seriously curtailed or closed entirely.

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